Response to USEPA Region 5 Comments on the Intermediate Design - H.O.D. Landfill

Comments from the USEPA Region 5 and oversite regarding the H.O.D. Landfill Intermediate Design are presented below followed by the respective responses. References cited in the responses to comments are listed following the last comment/response.

Predesign Investigation Results: Landfill Gas and Leachate Components

1. **Comment: Page 5, Section 2.1.2: This section references that Tables 1 and 2 contain "data on the as-constructed screen interval". However, this information is not contained on Tables 1 and 2. The information should be added or it should simply reference Appendix C.**

   Response: Subsection 2.1.2 of the Engineering PDI report has been changed such that the "data on the as-constructed screen interval" are referenced to Appendix C.

2. **Comment: Tables 1 and 2: Please clarify why the well depth for P1, P8 and P10 were not measured. A column should be added that indicates the current well depth in elevation. No construction information for P1, P8, and P10 was provided in Appendix C.**

   Response: The total well depths were not measured for P1, P8, and P10 because the existing leachate extraction equipment prevented the lowering of the PVC probe down the well casing. Note 6 has been added to Table 1 to indicate the obstructions, and a new column, labeled "MEASURED BOTTOM OF WELL ELEVATION," has been added.

   Because the 3 ¾- and 4-inch well diameters for P2A, P3A, P8, P9, and P10 are too small for the proposed pump type to be utilized at H.O.D., WMI does not plan on incorporating these wells into the final leachate management system. In addition, P1 is not proposed for use in the final leachate management system. The first bullet of Subsection 4.2 of the Engineering PDI report has been modified to indicate that these locations are not suitable for incorporation into the proposed active leachate extraction system due to the diameter of the well casing. Locations P8, P9, and P10 are proposed to be removed and replaced with new wells. See response to comment No. 29A for further information on the proposed leachate management system network changes.

3. **Comment: Page 9, Section 2.3.1: The statement regarding the lack of an unsaturated zone west and south of the site must be justified via cross-sections based on borings or previous investigations.**

Response: Per geologic Cross Sections A-A' and B-B' of the RI, the shallow water surface is at, or very close to, the surface to the south, and to the west, of the site. Sequoit Creek, which is located to the south, and to the west, of the site, is hydraulically connected to the surficial sand unit and the wetland areas to the south of the site. The shallow groundwater system in those portions of the site both discharge to, and receive flow from, the creek, dependent on the stretch of the creek and the time of the year (pages 3-6 and 3-7 of the RI). Thus, the saturated zone of the creek and the shallow groundwater system act as a barrier to the potential migration of landfill gas to the south and west of the landfill unit. This discussion is added to the text of Subsection 2.3.1, and geologic Cross Section A-A' is included as Appendix D to the Engineering PDI Report.

4. **Comment: Page 11, Section 3.5: The last statement should be qualified to say that the volume does not account for continued infiltration through the existing or new cover. In addition, it is reasonable to assume that due to the heterogeneity and anisotropic nature within the landfill, that the leachate levels would have to be drawn below 761 AMSL at the wells in order to ensure that 761 AMSL is achieved at the perimeter of the landfill, and to ensure an inward gradient is created. The calculations should be revised to address the above comments. Also refer to comment No. 21.**

Response: The calculations referred to in Subsection 3.5 of the Engineering PDI report were for a "static" leachate volume. Within the calculations included in Appendix E, it was noted that "to maintain this level, continued extraction would be required to account for infiltration, inflow from the surrounding aquifer, recovery of perched leachate, and continued waste consolidation." To clarify the report text, this language from the calculation set has been included with the wording of Subsection 3.5. The objective of the static leachate volume calculation within Appendix E was to "estimate the current volume of extractable leachate in the H.O.D. Landfill based on leachate levels measured during the November 1999 Engineering PDI and an assumed leachate maintenance level of EL 761." The main objective of the Engineering PDI (leachate component) was to physically verify the suitability of using existing wells for leachate removal and to assess the condition of the existing extraction system. This main objective was met. Information regarding measures necessary to achieve the required leachate drawdown within the landfill and related performance verification are discussed in the Prefinal Remedial Design Report.

5. **Comment: Page 12, Section 4.1, 1st bullet: The bullet should be revised to indicate that the eastern and northern boundaries have an unsaturated soil layer that is conducive to gas migration as stated on page 9 of the report.**

Response: The text in the first bullet in Subsection 4.1 has been modified to read "...limit the potential for gas to migrate off-site along the site's western and southern perimeter. An unsaturated soil zone is present outside portions of the eastern and northern landfill perimeter. The potential for this unsaturated zone to allow a pathway for horizontal LFG migration should be reviewed during the RD phase."

While areas to the north and east of the landfill have unsaturated surficial soil layers, the water table is located within 15 feet of the ground surface. The soil in the upper 20 feet is composed of fine-grained soil (see attached boring logs, Attachment A to this response letter). These fine-grained soil layers are generally not conducive to the horizontal migration of LFG. This issue is further discussed in response to comment No. 26.

6. **Comment: Page 12, Section 4.2, 1st bullet: Due to the heterogeneity and anisotropic nature within the landfill, the well points will most likely have to act as sumps and have screens below 761 AMSL in order to achieve 761 AMSL throughout the landfill especially at the perimeter. The following leachate probes, gas well flares, and leachate extraction points have a well depth greater than 758 AMSL and might not allow the flexibility to create the required drawdown across the site: GWF11, GWF12, LP6, LP10, LP11, LP12, LP13, LP14, and MHW. In addition, construction information and current well depth must be provided for P1, P8, and P10 before a determination can be made regarding their suitability. Also refer to comment No. 21.**

Response: It should be noted that not all areas of the landfill have a base elevation below 761 A.M.S.L. Therefore, in some areas of the site, extraction wells placed to the bottom of waste do not reach elevation 761 A.M.S.L. This condition applies to LP12, LP13, and LP14.

The first bullet in Subsection 4.2 has been modified such that GWF11 and GWF12 are not included in the list of existing points suitable for incorporation into the active leachate extraction system. The bottom of the screened interval for GWF12 is at 775.0 feet A.M.S.L., which does not allow for the flexibility required for leachate drawdown. In addition, the total depth of GWF11 was measured at 761.4, while the reported construction depth was reported as 753.6. Because of this discrepancy in the bottom depth, GWF11 is not recommended for possible incorporation into the RD.

In the Engineering PDI Report, no reference was made to the existing MHW bottom depth as related to achievement of an inward gradient. By their nature, manholes are placed at the landfill invert. In Subsection 4.2, it was simply recommended that the

existing leachate extraction manholes be incorporated into the final RD system to be utilized in conjunction with the dual extraction wells.

An additional bullet has been added to Subsection 4.2 stating that leachate extraction points P2A, P3A, P8, P9, and P10 are not suitable for incorporation into the proposed leachate management system because the small-diameter (i.e., <4") well casings would prevent the installation of the proposed leachate extraction pumps.

7. **Comment: Figure 1: The leachate contour lines between the perimeter of the landfill and the last wells should be dashed, since these are interpolated and not triangulated between known leachate elevations. In addition, shallow groundwater monitoring well water level measurements should included on the Figure 1 as a preliminary indications of whether an inward or outward gradient is occurring. Also refer to comment No. 55.**

Response: Figure 1 has been modified such that leachate contour lines between the perimeter of the landfill and the last wells are dashed. Shallow groundwater monitoring well water level measurements are also indicated on Figure 1.

Intermediate Design Report

8. **Comment: Section 1 should include a description of the selected remedy.**

Response: A section on the selected remedy has been inserted as Subsection 1.3 of the RD report. The existing Subsection 1.3 has been moved to Subsection 1.4.

9. **Comment: The design report does not include calculations for settlement due to the leachate drawdown. Leachate levels will be reduced by as much as 24 feet in certain portions (in the southwest quadrant of the "new" landfill and 10 feet in the "old" landfill). It is proposed to extract leachate slowly to reduce the effects of differential settlement; however, the overall settlement should be calculated to account for this in the grading plan and piping layouts. In addition, as indicated in Sheet 4 of 15, the western most waste consolidation area is located over the southwest quadrant of the "new landfill," and portions of this area will receive an additional 5 to 6 feet of waste and cover. This additional load will only increase the settlement in this area.**

Response: Based on the age of the waste, most of the expected general landfill settlement has already occurred across the site. The old fill area located on the western half of the site has experienced little additional settlement since it was capped in the late 1980s. A similar situation is expected in the new fill area located in the eastern half of the site after the RD cap is implemented. Because of the age of the waste (minimum

18 years since closure) and the planned gradual lowering of landfill leachate levels, large amounts of additional settlement (including differential settlement) are not expected.

There are predictive models available which could be used to predict possible refuse settlement (e.g., Sowers 1973, Gibson and Lo 1961, Edil 1990). However, it is not felt these models would accurately predict possible settlement if applied to H.O.D. Landfill. It is felt these models would not be accurate because:

- Effective stress is a function of refuse density (which cannot be estimated accurately, especially as a function of depth).
- The strain-log stress relationship is not a straight-line relationship; thus, the settlement coefficient varies as the stresses in the fill change.
- Bio-chemical decomposition and other physical-chemical changes take place over time which would continuously alter the modeled condition.
- Parameters required for these predictive models are not available for waste as old as 18 years.

Consequently, predictions of settlement, let alone differential settlement, are not practical for the H.O.D. Landfill.

The ROD specifies the landfill cover system be designed with a minimum 2 percent slope. This criteria provides for adequate drainage of surface water while minimizing the volume of fill soil placed on the site. This design feature is consistent with standard landfill remediation engineering practice. Any settlement that does occur at the site following RA construction will be repaired as detailed in the Operations and Maintenance Plan (O&M Plan).

The proposed piping layouts are situated predominately along the perimeter of the landfill mass where little differential settlement is expected. In addition, the pipes are sloped at a minimum of 2 percent to account for possible settlement, and the design of the landfill gas header pipe system allows for additional operational flexibility.

10. **Comment: Page 1-7, section 1.3.1: See comments *on Predesign Investigation Results Landfill Gas and Leachate Components*. Also, please explain how the presence of surface water bodies and wetlands bordering the Site limits the potential for landfill gas to migrate off-site.**

Response: The migration of landfill gas will follow the path of least resistance, which is typically to the atmosphere or through a permeable soil layer. Surface water bodies, saturated soil, and low-permeability soil are not conducive to the migration of landfill gas.

For consistency between the Engineering PDI report and the RD report, the RD report (Subsection 1.4.1) has been modified to reflect changes/additions noted in response to comment No. 5.

Cover System

11. **Comment: Page 3-2, 2nd paragraph, section 3.1.2: The design criteria, most notably permeability and compaction, of the final cover over relocated waste should be defined.**

    Response: The design criteria of the low-permeability fill layer and the vegetative layer to be placed over the waste relocation area have been defined with a new paragraph in Subsection 3.1.2. Specifications for the cover materials are provided in Specification Section 02320, and quality control is discussed in the CQAP (Section 9) submitted with the prefinal design submittal.

12. **Comment: Page 3-2, section 3.1.3 states that the cover design is in compliance with the maximum and minimum slopes established in the ROD of 25% (4:1) and 2% respectively. However, the area on the northern side of the access road on the northern side of the landfill shows a side slope of 3:1, or 33% on the Final Grading Plan, Drawing 4. Also, in Section 3.2, it is stated that cover side slopes range from 3:1 to 4:1. According to the ROD, slopes steeper than 4:1 may be allowable; however, the text should provide reasoning for why a slope steeper than 4:1 is being proposed.**

    Response: The buildout of the access road is considered separate and distinct from the final cover sideslope. In landfill construction practice, it is common to have access road sideslopes steeper than 4:1. No additional maintenance requirements are expected for the 3:1 sideslopes. This slope covers a limited area immediately adjacent to the access road.

    The language in Subsection 3.2 has been modified to read "The designed top slopes of the final cover are generally 2 percent, while the designed sideslopes are no steeper than 4:1. Other areas of the landfill where slopes are steeper than 4:1, including the slopes along Sequoit Creek, will not be disturbed as these areas have good soil cover and a healthy vegetative layer exists. Disturbance of these areas is not planned in order to limit the potential for erosion."

13. **Comment: Appendix C provides volume calculations for cover improvements. One calculation presents the amount of material required to establish final grades. The other calculations show that the cut volume from the borrow source that is equal to the fill quantity needed to meet the final grades within the area of cover improvements. Are the existing surfaces used in calculating these volumes reflective**

of the actual existing surfaces or of the existing surfaces following topsoil removal as described in Section 3.1.3? Does the final surface "fg2" used in the cover soil volume calculation include the 12 inches of topsoil to be placed as part of the cover? Is the volume of topsoil a wash in this calculation? Please clarify exactly what the input surfaces represent and exactly what volumes are being calculated in Appendix C.

Response: The volume calculations contained in Appendix C have been revised to include a more thorough "construction-level" soil materials balance, including estimated quantities for waste relocation and backfill, low-permeability fill placement, and borrow soil availability. For the soil borrow area, it was assumed that 6 inches of existing topsoil would be stripped and then replaced during borrow area restoration. For the landfill cap improvements, it was assumed that 12 inches of existing topsoil/vegetative cover would be stripped, stockpiled, and replaced during the regrading activities. In Appendix C, text descriptions of the surfaces used in the volume calculations are included along with the basis of the software program utilized in the calculations.

14. **Comment: Page 3-3, section 3.1.4, Borrow Soil, references a volume of 56.500 CY. Please correct this number to 56,500 CY to match the volume calculated in Appendix C.**

Response: Per the response to comment No. 13, a detailed soil balance has been conducted for the site (see Appendix C). Accordingly, Subsection 3.1 has been updated to match the volumes reported in Appendix C.

Landfill Gas Management - General

15. **Comment: At the bottom of Page 3-6 under Section 3.3.2 paragraph 2, the number of existing extraction wells is contradicting. One sentence says 21, another 22. Sheet 6 shows 21. Please correct the reference to be consistent. Please make appropriate changes in the report for consistency.**

Response: Per proposed modifications to the 60 percent landfill gas management system layout discussed in responses to comments No. 17 and 24, the number of existing wells proposed for incorporation into the active system is 15 (including the two retrofitted manholes), and proposed new wells number 20. Subsection 3.3.2 of the RD Report and Plan Sheets 6, 7, 9, and 11 have been modified accordingly.

16. **Comment: On the top of page 3-7 under section 3.3.2, how was the radius of influence for the gas extraction wells determined to be 150 feet? Provide the basis for this assumption.**

Response: The apparent radius of influence (ROI) around an individual gas extraction well is dependent on a large number of synergistic variables that, in the field, continuously change in response to barometric pressure, availability of gas, ratio of gas drawn to gas generation rate, movement of liquids to the well, climatic conditions, preferential gas pathways, and precipitation/infiltration into the landfill. There is no precise model that provides a quantitative basis for selecting well spacing and layout. Consequently, the design of gas vertical extraction wells and their spacing are a science requiring considerable engineering judgement. WMI used a combination of the following bases to lay out the proposed active landfill gas system:

a. In the SOW, it was stated that the ROI was expected to increase to between 100 and 150 feet per well for a proposed active LFG system. The layout of the proposed landfill gas system is similar to that proposed in the FS, with the exception that 20 new extraction points are proposed as replacements or upgrades to the system versus the 5 new points proposed in the FS.

b. Within the Municipal Solid Waste Landfill Gas Design Review, EMCON (1998) the following gas collector density is suggested:

TYPE OF LANDFILL CONDITION	APPROXIMATE SPACING OF VERTICAL EXTRACTORS
Migration control for adjacent structures	100 to 200 feet
Landfill with wet waste	200 to 300 feet
Landfill with dry waste	350 to 400 feet

c. Based on RMT's experience with designing, constructing, and monitoring landfill gas systems throughout the Midwest, the approximate 150-foot ROI is reasonable and appropriate for the H.O.D. Landfill.

Subsection 3.3.2 of the RD Report has been modified to include the above design discussion.

17. **Comment: There are numerous locations on Sheet 6 where the distance between two extraction wells is greater than 300 feet. This could result in a decreased efficiency of landfill gas collection if the radius of influence is 150 feet. There may be a need to install additional wells. Also refer to comment No 54.**

Response: As noted in the response to comment No. 16, the layout of the landfill gas collection system has been based on a variety of considerations in addition to a rigid radius-of-influence spacing. Twenty additional wells have been incorporated in the Remedial Design. In areas where migration is more of a concern, wells have been spaced closer together. This can be seen in the design along the perimeter of the site. In the western area of the landfill (old fill area), wells are spaced slightly further apart in some areas because gas generation is expected to be greatly reduced in this area. In addition, existing surface water bodies in this area reduce the likelihood of gas migration in this area. Per the O&M Plan and the PSVP, the landfill gas management system will be monitored for effectiveness during the O&M period. The need for additional gas extraction locations and/or system adjustments will be evaluated accordingly.

18. **Comment: What sort of connection will be made between the condensate discharge line and the leachate transport pipe? This connection should be shown in detail 4 on Sheet 12.**

Response: Detail 4 on Plan Sheet No. 12 has been modified to account for the connection between the condensate discharge line and the leachate transport pipe.

19. **Comment: Page 3-9, section 3.3.5, paragraph 2, discusses the gas header stub in the southwestern corner of the site. Evaluate whether a valve (within a valve vault structure) should be shown on this line to prevent gas flow during the construction of future connections. Describe the method of isolation if a valve will not be added.**

Response: Valves are sufficiently spaced throughout the system such that flow of LFG to this stub system can be cut off prior to potential future connections without shutdown of the entire system. Therefore, WMI does not propose to add an additional valve (and valve vault structure) upstream of the gas header stub at this time.

20. **Comment: Where is the specification/technical reference for the well head pumps for the condensate sumps? Design for this pump should be included in Appendix C, and a description of the required parameters should be called out on the plans or in the specifications.**

Response: The design for the condensate pumps and controls has been changed to be identical to the design proposed for the leachate extraction points.

21. **Comment: Page 3-9, Section 3.3.6: The section describes the gas monitoring probe locations. As indicated on page 9 of the *Predesign Investigation Results: Landfill Gas and Leachate Components,* the eastern and northern boundaries have an unsaturated soil layer that is conducive to gas migration. The eastern boundary has two proposed probes located on the corner and one existing probe in the middle. The spacing between these probes is approximately 400 feet. The northern side of the landfill, which is approximately 2,200 feet long, has one probe in the middle and one located on the eastern corner. Please provide justification for the spacing along the northern property boundary. It would appear that additional gas monitoring probes are required along the northern boundary. Also, as stated previously, additional documentation regarding the lack of an unsaturated zone west and south of the landfill due to surface water bodies being hydraulically connected to the shallow saturated zone should be provided. Also refer to comment No. 54.**

Response: As noted in the response to comment No. 3, the shallow water surface is at, or very close to, the ground surface to the south, and to the west, of the site as documented in geologic Cross Sections A-A' and B-B' of the RI. Thus, the saturated zone of the creek and the shallow groundwater system act as a barrier to the potential migration of landfill gas to the south and west of the landfill unit.

As noted in the response to comment No. 5, the areas to the north and east of the landfill have a limited unsaturated surficial soil layer composed of fine-grained soil. This low-permeability soil can be a very effective barrier to gas migration. Thus, in combination with an active LFG extraction system, gas migration is not expected to the north and the east of the site. As a result of the proximity of nearby structures east of the landfill, two additional monitoring probes along the eastern perimeter of the site were initially proposed. As a result of the lack of nearby structures and the existence of saturated ground conditions along the northern boundary of the site, one additional gas probe is proposed for this area. If there is evidence of gas migration in any area, additional monitoring for landfill gas will be conducted as detailed in the O&M Plan.

Subsection 3.3.6 has been modified to include the above discussion regarding the rationale for the selection of additional perimeter gas probes.

22. **Comment: Page 4-1, Section 4.1: In accordance with 35 IAC 811.310(b)(8), at least three ambient air monitoring locations shall be included as part of the landfill gas monitoring program. Also, in accordance with 35 IAC 811.310(d)(3), the blower\compressor building shall be monitored for methane using a continuous detection device.**

Response: Subsection 4.1 and Plan Sheet No. 11 have been updated to incorporate ambient air monitoring at three locations 100 feet from the waste boundary of the landfill. Per an e-mail message received from the USEPA on March 27, 2000 (attached in Appendix A of the RD Report), the H.O.D. Landfill is considered closed beyond 5 years. Accordingly, per 35 IAC 811.310 (c)(2)(3), an annual sampling frequency is proposed due to the installation of the active LFG management system.

For safety purposes, both portions of the blower/compressor building will include a continuous methane detection device (see Plan Sheet No. 8).

Leachate Management

23. **Comment: Page 3-10, section 3.4.1: The design criteria for leachate collection system should provide the zone of influence.**

Response: Reliable predictions of the zone of influence of leachate extraction wells through modeling are very difficult to make due to several factors, including the heterogeneity of refuse (e.g., compaction, degree of decomposition, gas content, and temperature), the presence of daily and intermediate covers, the effect of landfill gas pressure buildup, and landfill geometry (e.g., buried berms, ridges, and trench disposal geometry). Well productivity and zones of influence are expected to be variable over time and at each individual extraction well location.

The layout of the proposed leachate management system is similar to that proposed in the FS, with the exception that 20 new extraction points are proposed as replacements or upgrades to the system versus the 5 new points proposed in the FS. Based on RMT's experience with designing, constructing, and monitoring leachate extraction systems throughout the Midwest, the proposed leachate extraction network is reasonable and appropriate for the H.O.D. Landfill. The system was designed to meet the performance objectives of the leachate management system, as described in the SOW:

- Increase leachate collection efficiencies.
- Reduce leachate levels throughout the landfill to eliminate seeps.
- Induce an inward gradient from the surficial sand aquifer in the vicinity of the site.

The system, as proposed, will increase leachate collection efficiencies and reduce leachate levels throughout the landfill. Additional wells have been placed around the landfill perimeter to help ensure that an inward gradient will be achieved (also, see response to comment No. 24). Accordingly, WMI does not believe it is appropriate to provide a subjective and potentially misleading "zone of influence" analysis into the remedial design.

24. **Comment: Page 3-10, section 3.4.1, and Appendix C: For maintaining inward gradient, leachate elevation would be maintained to 761 feet above mean sea level. Based on verbal information provided during the intermediate design meeting, the 761 feet above mean sea level was determined after examining water elevation for one year from three shallow wells bordering the Site. Instead of using water elevations for a 1-year period, it is recommended that the elevations for all monitoring events be examined and the lowest available elevation be used for designing the leachate collection system. Furthermore, the prefinal design should provide rationale for selecting three wells to determine the design criteria for the leachate collection system. The prefinal design should also provide a detailed explanation why other shallow monitoring wells/piezometers around the landfill were not used to determine the elevation to be maintained by the leachate collection system for maintaining the inward gradient.**

Response: As discussed during the Intermediate Design meeting, historical shallow water levels in the vicinity of the site have been evaluated in order to determine the liquid level that must be achieved by the leachate management system in order to achieve the ROD requirement of maintaining an inward gradient at the landfill to control shallow groundwater in the surficial sand aquifer in the vicinity of the site. As described in Subsection 2.4.2 of the PSVP, records for wells PZ3U, PZ4U, G102, W5S, and W6S were reviewed for the last 10 years (1990 through 1999). These wells were chosen as representative monitoring wells because they are water level wells (not piezometric wells) located within the surficial sand aquifer at the southern perimeter of historical waste filling at the H.O.D. Landfill.

Total precipitation data for this 10-year period, as measured at the Lake Villa, Illinois, station, were obtained from the Midwestern Regional Climate Center (Table 2-4 of the PSVP). The Lake Villa station data were used because precipitation data for the Antioch, Illinois, station are incomplete (Traci Westfall, Service Climatologist, Midwestern Regional Climate Center, personal communication). Of those 10 years, the driest were 1992, 1994, and 1995. Table 2-5 of the PSVP summarizes historical water level elevations for the five wells during each of the 3 driest years. The average water level elevation for the wells during the 3 years is 761.77 feet.

The design criteria for each leachate extraction well should consider the following data:

1. **Comment: Bottom of the waste.**

   Response: Bottom of waste considerations have been incorporated into the design. All new dual extraction wells proposed as part of this design will be constructed to the bottom of waste in order to effectively capture leachate from the waste mass. GWF12 and LP12, 13, and 14 have been replaced with new extraction wells because the existing screen intervals were not ideally placed to capture leachate near the base of the waste mass (see above response and response to comment No. 6). It should be noted that waste was not placed below EL 761.7 feet A.M.S.L. in all areas of the landfill.

2. **Comment: Height of the pump is not provided; therefore, it is not known if this has been considered in the current design.**

   Response: The proposed pump is a submersible bottom-loading pump, therefore, the pump height is not a critical design feature.

3. **Comment: Based on the review of the curves provided in Appendix C, for the optimal operation of the pump, the submergence for the pump should be two feet.**

   Response: Submergence depth is not a set feature. The proposed pneumatic pumps adjust the discharge flow rate automatically to match well yield up to the pump capacity. The pumps will draw liquid levels down to within approximately 1 foot of the pump bottom.

4. **Comment: The pump will be installed at level (not provided in this design submittal) above the bottom of the well.**

   Response: In order to achieve a more uniform lowering of leachate levels, the pump inlet in each well will initially be set at EL 757 feet A.M.S.L., or 1 foot above the well bottom in areas where the base of waste is above EL 757 feet A.M.S.L.

5. **Comment: In order to achieve the capture zone, the expected drawdown in the leachate well should be considered. This is not included in this design submittal.**

   Response: See response to comment No. 23.

Comment: It is recommended that the above information be used to re-evaluate the current leachate extraction system.

Response: The proposed leachate extraction system has been designed to accommodate the above considerations. As described previously, modifications to the Intermediate Design submittal have been incorporated where noted.

25. **Comment: Page 3-11, section 3.4.2: The HELP model for the landfill cap included in the approved FS has calculated inflow into the landfill to be 5897.101 cubic feet per acre. This results in 2.25 million gallons per year. The design has estimated 16.4 million gallons of leachate above 671** (note, reference believed to be 761) **feet mean sea level. At the intermediate design meeting, WMI mentioned that it expects to withdraw 3,000 to 6,000 gallons per day, which is equivalent to 1.1 to 2.2 million gallons per year. The daily leachate extraction rate recently mentioned in the meeting will not be able to lower the leachate level within the landfill, because the infiltration rate is slightly higher than the anticipated maximum extraction rate. Therefore, it is recommended that a time line for lowering the leachate in the landfill be provided in the design. Furthermore, the design should include calculations to show how the leachate will be lowered to the set elevation of 671** (note, reference believed to be 761) **feet mean sea level (although this elevation may change). The design should also include the extraction rate to be set for each pump during operation to lower the leachate level in the landfill.**

Response: During the Intermediate Design meeting, WMI noted an expected long-term leachate extraction rate of between 3,000 to 6,000 gallons per day. WMI recognizes that leachate extraction rates during the initial operation of the leachate collection system will be greater than the predicted long-term rate. Increased extraction rates will continue until a long-term maintenance rate is achieved. With respect to infiltration, WMI expects that the actual infiltration at the site would be at, or below, the low end of the range predicted between the RI (1 MGY = 2,740 GPD) and the FS (assuming 1.6"/year over 51 acres = 2.2 MGY = 6,070 GPD). The lower range is expected for the following reasons:

- Extending the 1.6"/year calculated infiltration rate over the entire site acreage of 51 acres is not representative because approximately 20% of the site consists of sideslopes at slopes ranging from 3:1 to 6:1.
- Hydraulic conductivity measurements conducted during the FS (both laboratory- and field-scale), the existing low-permeability clay layer was in the 1 x 10^{-8} cm/s range. However, a hydraulic conductivity of 1x10^{-7} cm/s was used in all HELP model analyses. Furthermore, Boutwell field permeability tests conducted on the overlying cover soil were in the range of 1 x 10^{-5} cm/s, whereas HELP model

analyses used 1 x 10^{-4} cm/s for this layer. The use of these higher hydraulic conductivity values in the model analyses was conservative.

- While HELP is a fundamentally sound model when used to compare different cover types, the use of the model to predict leachate generation rates is highly questionable. Studies on long-term field measurements on earthen final covers, Benson & Pliska (1996) and Khire et al. (1997) noted that the HELP model tends to over-predict actual infiltration through earthen covers. In the Benson & Pliska paper, HELP significantly (up to 3 times more in a 4-year field study) over-predicted percolation from all three test sections used in the study.
- The FS assumed that most of the fill soil for the regrading of the landfill would come from the existing cover. For the current design, this is not the case. Fill soil is being imported from a borrow to the north of the landfill, and the grades are generally being "built-up" from existing levels. This effort should lead to further improvements to the cover system and, consequently, lower infiltration rates.

It is not appropriate to estimate the productivity of each well due to the likely heterogeneous physical properties of partially decomposed refuse and the presence of clay daily cover. However, assuming that 3,000 to 6,000 gallons per day are removed from the landfill (including both infiltration and lowering of existing leachate levels), this calculates to an extraction rate of 0.06 to 0.12 gpm from each extraction location. This is well within the capability of the pump selected for use in the RA (see Appendix C of the RD). Evaluation of the adequacy and performance of the extraction system will be part of the review process, which will take into account the measured productivity of the system (i.e., volume of leachate removed) and the reduction in liquid levels as measured at the extraction and monitoring well locations. Once operating data is available, adjustments to the operation of the system can be made to improve system efficiency.

26. **Comment: Page 3-2, section 3.1.3: Based on the leachate levels presented in Figure 1 of the *Predesign Investigation Results: Landfill Gas and Leachate Components*, drawdown of the leachate levels could be as much as 24 feet. This drawdown would result in settlement of the waste mass as previously described. It does not appear that settlement has been accounted for to determine the final grades. Provide the appropriate design calculations demonstrating that the cover will maintain the 2 percent minimum top slope following withdrawal of the leachate.**

Response: See response to comment No. 9.

27. **Comment: On Sheet 6, provide clarification on the leachate forcemain shown from the storage tank to the southwestern corner of the landfill for possible future connection to the sanitary sewer. Where does it connect into the storage tank? Will it take the place of the line attached to the submersible pump? If so, there should be a tee connection and valves to direct flow from the storage tank into either a tanker**

truck or down to the sanitary sewer. Is the submersible pump sized to only pump flow up to the tanker truck or is it sized to pump flow out to where it would connect into the sanitary sewer? Provide submersible pump design calculations to meet both short-term and long-tern intentions of the system.

Response: Additional detail on the connection and valving of the forcemain for future use from the storage tank is shown on Plan Sheet No. 13.

The leachate pump within the storage tank has been sized for loading tanker trucks at the lift station. It is expected that this pump will be adequate if a sewer connection is approved in the future. If and when details of a sewer connection become available, the adequacy of the leachate load-out pump will be evaluated.

28. **Comment: How was the 20,000-gallon storage tank sized? Will this be sufficient storage capacity for the expected leachate collection rate of 30 gpm (from Appendix C)? Is the rate of 30 gpm expected to be continuous? If so, this would amount to 43,000 gallons of leachate per day, which would require completely emptying the storage tank at least twice per day 35 IAC 811.309 states that leachate storage must be able to store a minimum of at least five days worth of accumulated leachate at the maximum generation rate used in designing the system. Since the sizing of the storage tank must comply with the 811.309 ARAR, the 20,000-gallon storage tank appears to be significantly undersized. An explanation should be given presenting the sizing of the tank and applicable requirements. If 20,000 gallons is the designed storage, how will the frequency of emptying be handled during initial operation when the highest collection rates would be expected?**

Response: The leachate tank size was set based on a number of practical considerations, experience at similar facilities, and the following technical issues at the site:

- The 5-day storage capacity requirement stated in 35 IAC 811.309 is required for new/active landfills with basal leachate collection system (LCS) base layers in order to ensure that less than 1 foot of head is maintained on liner systems. H.O.D. Landfill is <u>not</u> a new/active landfill and does <u>not</u> have a basal LCS system. Therefore, direct application of the regulation is not appropriate. However, the condition most closely matching the referenced ARAR would be long-term leachate level maintenance condition. This condition balances leachate extraction with infiltration rates through the cover. Based on the preceding information, the 20,000-gallon storage capacity proposed in this design is more than adequate to meet the intent of the referenced ARAR.
- Based on RMT's industry experience and similar WMI facilities in the region, the 20,000-gallon tank is appropriately sized. In particular, a closed remediated landfill southwest of Milwaukee is a very similar site with 30 wells spaced over 60 acres. For this site, on average, approximately 6,000 to 7,000 gpd are removed.

- The maximum 30 gpm rate was for design of the leachate header, not the storage tank.
- Regardless of storage capacity, the same volume of leachate must be transported from the site (e.g., three loads removed once every 3 days or one load removed for three consecutive days). Additional storage capacity will only delay the frequency of tanker loads being hauled from the site (i.e., 1 or 2 days).
- As needs dictate, temporary storage capacity could be brought to the site, the haul-out schedule could be adjusted, or efforts to connect to a local sewer could be initiated. These contingencies are addressed in the O&M Plan and the PSVP.

29. **Comment: The leachate storage tank should have a secondary containment system with leak detection and the capability of collection of accumulated/leaked leachate in accordance with 35 IAC 811.309 and 725.293. An exception would be where the landfill cover has two feet of clay and a permeability of no greater than 10^{-7} cm/sec. In this case, the tank would not need the secondary containment system, but would still need leak detection.**

Response: The design of the leachate storage tank has been modified to include secondary containment and leak detection.

30. **Comment: Page 3-11, 1st Paragraph, section 3.4.2.: Calculations determining the cone of depression should be presented.**

Response: See the response to Comment No. 23.

31. **Comment: Page 3-11, 2nd Paragraph, section 3.4.2.: Calculations for the estimated volume due to continued infiltration through the existing or new cover should be provided. An estimate for the time to reach the 761 AMSL level should be provided.**

Response: Per response to comment No. 25, Subsection 3.4.2 has been modified such that WMI's estimate of approximately 3,000 gpd of continued infiltration through the improved cover is included. Because of the complex set of environmental conditions and design variables, WMI hesitates to estimate a time to reach drawdown at this time. Rather, WMI is committed to meeting the performance objectives stated in the Remedial Design (as mandated in the ROD) which will be evaluated on an ongoing basis during the O&M period and as assessed in the PSVP.

32. **Page 3-11, Section 3.4.2: The following comments apply to Section 3.4.2:**

A. **Comment: It is reasonable to assume that due to the heterogeneity and anisotropic nature within the landfill, that the leachate levels would have to be drawn below 761 AMSL at the wells in order to ensure that 761 AMSL is achieved at the perimeter of the landfill and an inward gradient is created. The**

following wells that have been included in the leachate collection system appear not to have the appropriate bottom screen depth to effectively drawdown the leachate: GWF11 (761.4), GWF12 (775), LP6 (758.9), LP10 (758), LP11 (759.8), LP12 (763.5), LP13 (764.2), LP14 (760.9), and MHW (759.3). Also refer to comment No. 24.

Response: Per the response to comment No. 6, the following applies to the individual wells noted above:

LOCATION	COMMENT
GWF11 and LP6	Are not proposed in the Remedial Design to be included as dual extraction wells.
GWF12	Proposed to be replaced with GW24, which will be drilled to the base of waste.
LP10 and LP11	Wells are constructed to the bottom of waste.
LP12, LP13, LP14	Proposed to be replaced with GW26, GW27, and GW28, respectively, which will be drilled to the base of waste.
MHW	This location is a sump for an existing toe drain and will be incorporated into the Remedial Design.

B. **Comment: The maximum design leachate extraction per well is 2 gpm for 12 hours which equates to total of 30 gpm based on 30 wells operating 50% of the time at a rate of 2 gpm (from Appendix C). Thus, each well would generate a maximum extraction rate of 1 gpm. However, realistically, this rate will reduce as the head levels are reduced. What are the expected average daily extraction rates and what is the estimated time frame to reduce the leachate levels to 761 AMSL including an infiltration rate of 1.6 in/year based on the Feasibility Study.**

Response: See response to comment No. 25.

C. **Comment: Discussions regarding the advantages and disadvantages of leachate well pump tests to determine the effective extraction rate, radius of influence, and drawdown time to support the existing design should be included in the design report. It appears that no additional predesign tests are proposed; therefore, it is critical to include a detailed discussion of the above issues as well as to include a contingency plan in the event leachate is not drawn down or the inward gradient is not achieved in a reasonable time period to achieve the goals stated in the ROD.**

Response: Reliable predictions of the zone of influence of the leachate extraction wells are very difficult to make due to several factors (see response to comment

No. 23). Well productivity and zones of influence are expected to be variable over time and between well locations.

In brief, monitoring for short-term performance will be performed during and immediately following system startup to estimate system drawdown while the system is active. Monitoring for long-term performance will be performed to estimate system effectiveness in reducing overall leachate head levels. Extraction wells (see response to comment No. 55) will be used for this monitoring task. This information will be useful in estimating the static leachate head levels to determine the overall rate in leachate head reduction at the site over time.

As outlined in the PSVP, the leachate management system will also be evaluated by reviewing pumping records for each well and identifying those with low production rates. Per the O&M Plan, if a well intake has been clogged (e.g., by bacteria or solids), appropriate steps will be taken to obtain better production. If leachate levels are not being significantly lowered in the vicinity of a nonproductive well, it may be necessary to evaluate, as outlined in the O&M Plan, whether other action should be taken to lower heads in that area.

33. **Comment: Page 3-11, Section 3.4.3: In addition to existing and new vertical extraction wells, the selected leachate collection system in the ROD (LC4) included a toe-of-slope collection piping along the north and south perimeter of the "new" landfill only. Justification for not including this collection piping should be provided. It would be expected that if only the interior wells are used to slowly draw down the leachate levels that existing leachate seeps along the side slopes would not be mitigated for period of time. As estimated previously, this time frame should be estimated.**

Response: Drawdown of the leachate levels in the landfill will be accomplished with vertical wells and the existing toe of slope drain pipes (MHE and MHW). Cross Section E-E' (Figure 16 of the RI, see Attachment 2 to these response comments), along with borings along the northern perimeter of the "new" landfill (see Attachment 1), demonstrates that the clay diamicton is laterally continuous to the north of the waste mass. In addition, Cross Section E-E' indicates that the southern perimeter of the "new" landfill is composed of a clay fill "berm" (this is supported by descriptions of the landfill construction process reported in the RI). Along with the steep interior waste slopes along these perimeters, toe drains would not be beneficial or technically constructible.

Toe drains are not practical or constructible because the steep slopes would necessitate an extremely deep excavation (potentially up to 40 to 50 feet deep) in order to place the toe drains to waste base grades. Current trenching technology (e.g., shoring boxes or

trenching machines) typically precludes trench depths of greater than 20 feet. Furthermore, such an excavation would require disturbance of a massive amount of waste, which in turn would create substantial nuisance and health and safety concerns.

Leachate seeps were not observed during the Engineering PDI. Seeps on the sideslopes are expected to become less likely to occur after the leachate collection system is operational. Extraction wells at the perimeter of the site will effectively control liquid levels in those areas. For the O&M period, regular inspections are planned (see O&M Plan) with appropriate contingency plans. In addition, the performance evaluation process will be in place to assess the performance of the leachate management system as currently designed.

34. **Comment: Page 4-1, Section 4.2: Leachate elevation measurements shall only be reduced from monthly to quarterly following USEPA approval.**

Response: The program for leachate monitoring is being proposed for USEPA approval. Measurement of monthly leachate elevations is proposed for the O&M start-up period only and was not an ARAR requirement. Since the leachate drawdown process and the related O&M period are expected to be long term, more frequent measurements will not benefit the evaluation process.

Groundwater Monitoring

35. **Comment: Page 4-2, Section 4.4: Groundwater monitoring locations, parameters, and frequencies shown on Plan Sheet No. 11 will not be approved until after the Groundwater Predesign Investigation Report and Operations and Maintenance Plan are approved.**

Response: The FSAP and QAPP are included with the prefinal design submittal for review. The Groundwater PDI report is scheduled for submittal shortly.

Plans

36. **Sheet 4 of 15 Security Fence.**

A. **Comment: What is the purpose of the pedestrian gates shown? Provide detail for the gates.**

Response: The pedestrian gates will provide access to monitoring locations outside the perimeter fence.

B. **Comment: How does the fence tie into on south side of the property?**

Response: The fence at the southern property boundary will end at the edge of Sequoit Creek.

C. **Comment: The Feasibility Study and page 55 of the ROD call for perimeter fencing with barbed wire. Page 3-14 (section 3.7.1) and Detail 2 of 14 on Sheet 14 do not mention barbed wire for the perimeter fencing. Please explain why the intermediate design is deviating from the ROD requirement for perimeter fencing with barbed wire.**

Response: In an effort to make the perimeter fence compatible with potential end uses, WMI does not propose to install a 3-strand barbed wire on the perimeter fencing. The intent is to ensure site security and remain compatible with the surrounding land uses. All interior control features will be secured with locks, and the blower/compressor and leachate loadout area fence will have the barbed wire system.

37. **Sheet 4 of 15 Access Road.**

A. **Comment: Provide spot centerline elevations for the roadway.**

Response: The access road will be located and graded to match the final cover slopes as shown on the plan set and constructed in the field. Elevations and coordinates are not needed for construction.

B. **Comment: Provide horizontal control for roadway layout.**

Response: See response to 37A.

C. **Comment: Side slope variance should be limited to 1/4 in./ft. on the roadway cross section.**

Response: The road is sloped across section at approximately 1 to 2 percent to allow sheetflow of surface water.

D. **Comment: Does the roadway have a crown or is it sloped across section? The detail appears to show that the road slopes across section.**

Response: See response to comment No. 37C.

E. **Comment: It is unclear how contours across the road at 1052000 E and 2116500 N tie into existing contours.**

Response: At this location, the shoulder slopes of the access road will be blended to tie into the existing grades as required. Further detail of this road is not believed to be necessary for construction.

F. **Comment: The roadway ends on the north end of the Site. How or where does the road go north of 2116900?**

Response: This road will be used to provide access to the borrow source during construction, and to the WMI property north of the landfill in the future.

G. **Comment: Profile and section for the roadway should be included in the prefinal design.**

Response: See response to comment 37A. Profile and sections for the proposed gravel access road are not necessary. The plans, detail, and specifications for roadway material are sufficient for construction.

H. **Comment: Show existing access roads.**

Response: Existing access road locations are shown on Plan Sheet No. 3.

I. **Comment: Provide grading for the access road out of the capped area.**

Response: See response to comment No. 37A.

J. **Comment: How is roadway runoff handled?**

Response: Surface water runoff will be handled as sheetflow across the roadway and across the final cover.

38. **Flare/Building**

A. **Comment: Detail 2/15 indicates that the building and flare separation is 30 feet; Sheet 4 of 15 shows the building/flare separation as approximately 20 feet. With separation of 30 feet, the flare will be in the fence. Please correct this inconsistency.**

Response: The plan sheets and details have been changed to show a separation distance of 30 feet.

B. **Comment: What is the separation between the fence and the flare (5 or 10 feet)?**

Response: The separation distance between the fence and the flare is 15 feet.

C. **Comment: Include the fence location on detail 2/15 and correct layout relationship between the building, flare, and fence on Sheet 4 of 15.**

Response: Detail 2/15 has been revised to show the layout of the building and flare. The spatial relationship of the building, flare, berms, and fence is shown on Plan Sheets 6 and 7.

D. **Comment: Provide building and equipment pad, or frame support dimensions.**

Response: This equipment will be sized based on the manufacturers' recommendations and the size of equipment within the building.

E. **Comment: Does flare/building location meet code?**

Response: The proposed building is located to meet the needs of the Remedial Design. The building has been designed primarily to enclose the blower, compressor, and control panels. While location-specific ARARs (including building codes) were not listed in the ROD, the building has been designed to meet Class 1, Division 2 Hazardous Location Ratings Group C and D (e.g., explosion-proof fixtures, methane monitoring, etc.).

F. **Comment: Provide the structural design for the rebar and corner bar.**

Response: The proposed layout of rebar for the flare/builds is shown on Detail 1. Details of the building pad will be further reviewed upon selection of a specific building. The building pad design will be modified if needed to meet the manufacturer's recommendations.

G. **Comment: The American Concrete Institute (ACI) recommends a 3-inch clearance between soil and rebar.**

Response: Detail 3/15 has been changed to indicate separation distances for rebar.

H. **Comment: Provide spot elevations for building layout (top view) in detail 1/15 and/or Sheet 7 of 15.**

Response: The elevations of the building will be determined during construction.

I. **Comment: Sheet 7 of 15 depicts the McMillen Road right of way (R.O.W.). Why is the pavement not shown at the access tie in?**

Response: Sheet 7 of 15 is an electrical layout plan and is not intended to show all physical surface details. In addition, Sheet 7 of 17 has been revised to focus in on the blower flare station area.

39. **Loadout Facility**

A. **Comment: Provide spot elevations for the loadout facility.**

Response: The exact elevation of the loadout facility will be determined during construction.

B. **Comment: Do pads' north/south drainage slope towards the middle?**

Response: The design of the loadout pad has been revised to include a drain and adequate drainage slopes.

C. **Comment: Provide drain from slab back into tank. Drain cap should be removed during loading.**

Response: See response to 39B. A drain cap will not be used to prevent the ponding and freezing of surface water on the pad.

D. **Comment: The leachate tank does not include all necessary lines to allow for loadout, forcemain to future sewer, and vacuum truck connections.**

Response: Details on Plan Sheet No. 13 have been revised to include all lines.

E. **Comment: Where are the designated contractor staging areas?**

Response: The designated contractor staging areas will be in the northwestern corner of the site and to the north of the "new" landfill.

40. **Comment: On detail 1 of Plan Sheet 13, what gauge will be provided for the welded wire fabric?**

Response: A 6 x 6 - W2.9 x W2.9 welded wire fabric will be used. Detail 1 on Plan Sheet No. 13 has been modified to address this detail.

41. **Comment: Will portions of the existing "unpaved road" shown on Sheet 3 remain, especially those portions outside of the cover improvements, or is the entire road being removed and replaced with the proposed aggregate road shown on Sheet 4?**

Response: Aggregate basecourse from the existing "unpaved roads" will be stripped and stockpiled on-site for use in construction of the proposed access roads, with one exception. The westernmost 200 feet of the existing "unpaved roads," adjacent to McMillen Road, will remain in-place and will be tied-in to the newly constructed roadway. This portion of road will likely require some minor improvements (i.e., widening and minor grade adjustments) as part of construction.

42. **Comment: Detail 1 on Sheet 14 shows 4 inches of aggregate surface course and 8 inches of aggregate base course. Specification Section 02720 describes an aggregate base course of no less than 6 inches in depth, which will serve as the final surface of the road. The specification should be revised to allow for an aggregate base course of no less than 8 inches in depth.**

Response: The specification referenced deals with the initial lift only.

43. **Comment: On Sheet 9 - Piping and Instrumentation Diagram (P&ID), the leachate header line that comes from LP1, 2, 3, 4, 10, 11, 12, 13, 14, and GWF1 stops and does not connect into the main leachate line to the storage tank. Please show an accurate representation of the leachate piping.**

Response: Plan Sheet No. 9 has been updated to show this connection.

44. **Comment: On Sheet 9, why are there gas lines coming from leachate extraction wells/manholes MHE and MHW? These structures were not included in the list of extraction wells designated to become combined leachate/gas extraction wells. Sheet 6, Leachate and Gas Management System Layout, does not show these wells located right on the main line. Should they be, or is piping running from the main line to them? Further explanation should be provided for the plan/use of these structures in relation to the leachate collection system.**

Response: Detail 6 on Plan Sheet No. 14 has been included to demonstrate the proposed retrofits to MHW and MHE and related conversion to dual extraction points.

45. **Comment: Structural plans should be included for the building. Include design specifications for walls, roof, doors, heating and ventilation, insulation, lighting, etc. At a minimum, if plans will not be provided, an explanation should be included in the prefinal design describing the conceptual plan and the intent for a design/build subcontract.**

Response: WMI intends to use a prefabricated building for the blower/compressor structure. At this point, the supplier has not been identified. Once the supplier has been identified, specific information on the proposed structure will be submitted for comparison to specifications.

46. **Comment: Provide wall penetration details for building.**

Response: WMI intends to use a prefabricated building for the blower/compressor structure. At this point, the supplier has not been identified. Once the supplier has been identified, specific information on the proposed structure will be submitted.

47. **Sheet 8 of 15**

A. **Comment: Note 15: exhaust fan: Against what pressures will the fan deliver 1050 cfm? Note 15 is not clear about pressure assumptions.**

Response: The fan is rated for approximate flows at air pressures close to ambient.

B. **Comment: Define the numbers in ovals in the legend. They correspond with notes on the Sheet, but are not referenced in the legend.**

Response: The legend on Plan Sheet No. 8 has been modified to let the viewer know that numbers correspond to notes.

C. **Comment: Note 36: It is recommended that the posts be at least 36" and preferably 42" below grade with 24-inches in diameter of concrete.**

Response: The design of posts, depths, and amount of concrete is thought to be adequate for the intended purpose of the design based on industry experience.

D. **Comment: Are emergency lights to be installed in the building?**

Response: Emergency lights are not included in the design of the building.

48. **Sheet 9 of 15**

A. **Comment: How is the high level measured in the condensate sumps?**

Response: The condensate sumps have been redesigned to use the same pneumatic pumps and controls as the gas and leachate extraction wells. Each pump will have a liquid level indicator within the vault at the wellhead. Liquid levels will be checked during routine maintenance to determine if pumps are functioning as intended.

B. **Comment: How does condensate pump/leachate extraction pump failure reach the programmable logic controller (PLC)/alarm panel?**

Response: Failure of an individual pump will not be detectable with the PLC. Individual pumps will be maintained, operated, and inspected as discussed in the O&M Plan.

49. **Sheet 15 of 15:**

A. **Comment: Treatment Building Layout calls out for an orifice plate flow meter. Why is this meter not shown on the P&ID?**

Response: Plan Sheet No. 9 has been revised to include an orifice plate.

B. **Comment: Where does the flow meter tie in? Does it interface with other equipment?**

Response: The location of the flow meter is shown on Plan Sheet No. 15. The orifice plate will be read manually.

C. **Comment: Where is the flow totalizer and readout?**

Response: See response to 49B.

D. **Comment: Is there a high pressure alarm on the compressor?**

Response: A high-pressure shut-off will be included on the compressor. A specific high-pressure alarm is not proposed. However, the compressor will include an automatic shut down due to high pressure.

E. **Comment: What is the purpose of the butterfly valve on the blower inlet line prior to the solenoid?**

Response: The purpose of the butterfly valve is to regulate system flow.

F. **Comment: Should the blower include flexible connections on the inlet and outlet?**

Response: Yes, they are shown in detail on Plan Sheet 15.

G. **Comment: Show the flame arrester on line to the flare.**

Response: The flame arrester is shown in detail on Plan Sheet 15.

H. **Comment: Where is the forcemain for future sewer discharge?**

Response: The location of the forcemain for a potential future sewer connection is shown on Plan Sheet 6 and in Detail 2/13.

50. **Sheet 12 of 15:**

A. **Comment: Note 2, detail 2/12: What are the traffic loads that the cover must withstand?**

Response: The traffic loads that the landfill covers may potentially experience are from service vehicles and maintenance equipment.

B. **Comment: Is the vault lid watertight?**

Response: The vaults, as proposed, will not need to be watertight.

C. **Comment: Provide a detail for the well and pipe penetrating the cap.**

Response: Details of the well and the wellhead are shown on Plan Sheet 12. These details are suitable for construction.

D. **Comment: Is there a freeze potential for the leachate line?**

Response: The potential for freezing of the leachate discharge pipes has been minimized by placing the wellhead in a vault below grade. In addition, the collected landfill gas will act as a heat source to keep the interior space of the vault above freezing.

E. **Comment: The vault has an open bottom which potentially would allow for water to drain out. The vault sits on top of GCL and below the top of impervious soils. If the lid is not watertight, condensate or frost could build up. Where is the water going to go?**

Response: The ½-inch drain line and valve connected to the header connection pipe in the vault will be operated to suction out any water that accumulates in the vault. Collected water will be routed to the condensate sumps, where it will be managed with the site leachate.

F. **Comment: Should the vault have a closed bottom?**

Response: A closed bottom on the vault is not considered necessary.

G. **Comment: What is the vault maintenance concerning water removal?**

Response: See the response to comment No. 50E.

H. **Comment: In the first full paragraph of page 3-7, section 3.3.2, it says that the extraction wellheads will be located below grade in a vault. However, Sheet 12 seems to show the wellhead above grade. Please correct this apparent inconsistency. Also, if the wellhead is above grade, please show in Sheet 12 the distance of the wellhead above grade.**

Response: The construction of the extraction wells includes a "stick-up" as shown on Plan Sheet No. 12. During the construction of the wellhead, the vault's "stick-up" will be shortened as required to meet the then final grades.

51. **Sheet 15 of 15**

A. **Comment: Does not show any condensate knock-out tank high level switch (shown on Sheet 8/15) or indicate any interlock with blower.**

Response: The condensate knock-out on Sheet 8/15 was inadvertently shown. A condensate knock-out tank is not necessary at this location since a "T" in the header pipe is located approximately 50 feet to the south of the blower building. The condensate from this portion of the gas header will flow to the collection sump at the southwest corner of the site.

B. **Comment: Should show interlock/alarms for gas flare.**

Response: Information will be provided once the flare manufacturer has been selected.

C. **Comment: Should show flame arrester, orifice plate flow meter, and sample ports for LFG system.**

Response: The location of these items is shown on Plan Sheet 15.

D. **Comment: Not clear which systems are interlocked - symbol the same for all interlocks and does not indicate which devices are interlocked.**

Response: The interlocks are tied into the main PLC. The PLC program reflects the sequence of operations for this system (see specification 16010).

E. **Comment: Need more detail in general on ground flare system.**

Response: The blower flare system will be constructed and installed based on the performance criteria outlined in the RD Report and the general layout shown in the plan set. Specific details of the system will not be available until the system manufacturer is selected. Detailed drawings of the blower flare system will be included in the Record Drawings.

F. **Comment: Should show LFG wellhead orifice plate flow meter and butterfly valve.**

Response: The LFG wellhead is shown in Detail 2/12, including the orifice plate location and butterfly control valve.

52. **Sheet 12 of 15**

A. **Comment: Call out diaphragm pump in Detail 4/12.**

Response: See response to comment no. 20.

B. **Comment: Specify load ratings of well vaults.**

Response: The loading rates for the vaults will be sufficient to handle loads from maintenance vehicles.

C. **Comment: Detail 2/12 calls for a leachate level indicator, bit this is not specified in the text of the Intermediate Design Report. This needs clarification.**

Response: Liquid level measurements at each dual extraction well are discussed in Subsection 4.2 of the Design Report.

53. **Sheet 13 of 15**

A. **Comment: Need to show ball valves on loadout risers that are shown in P&ID.**

Response: Sheet 13 has been updated to show the locations of the valves on Details 1 and 2.

54. Sheet 11 of 15

Landfill Gas Monitoring Probes

Comment: The landfill gas monitoring probes recommended are not adequate. It is recommended that detailed analysis be provided to ensure that no landfill gas will migrate off-site. The adequacy should be determined based on the expected zone of influence of each extraction well, the well spacing, and placement of monitoring probes.

The monitoring schedule for gas monitoring is recommended as follows:

- **Daily for first week of operation.**
- **Weekly for the next three months, if the data collected during initial daily measurement shows that the system has stabilized based on the vacuum measurements.**
- **Monthly for next nine months.**
- **Quarterly thereafter.**

35 IAC 811.310(c)(3) allows for an alternate, annual monitoring frequency "upon the installation and operation of a gas collection system equipped with a mechanical device such as a compressor to withdraw gas." The USEPA needs to approve any proposed monitoring frequency before it is implemented.

Response: The proposed monitoring frequency for landfill gas follows 35 IAC 811.310(c)(1)(2)(3). The recommended frequency proposed above goes above and beyond the requirements of this ARAR. Per e-mail correspondence from the USEPA (March 27, 2000) to WMI (with concurrence from the IEPA), "Since there will be an active gas collection system in place, we can go to annual monitoring soon after the system is operational." The proposed monitoring frequency (monthly for a start-up period of 3 months, then annually thereafter) sufficiently covers this requirement.

Per the response to comment No. 21, an analysis of the gas monitoring probes' layout and adequacy has been conducted. Considering that no landfill gases were detected in the three perimeter landfill gas probes (GP3, GP4A, and GP5A) during the RI, landfill gas migration is not expected after start-up of the active gas management system. However, three additional gas probes are being located on the perimeter of the landfill as shown on Plan Sheet No. 6. Additional steps to monitor for landfill gas migration are outlined in the O&M Plan.

55. Sheet 11 of 15

Leachate Monitoring Probes

Comment: None of the leachate monitoring probes recommended are outside the current waste limits, and all leachate wells have been proposed for monitoring leachate levels. It is recommended that piezometers be installed outside the waste limits to ensure that a inward gradient is achieved during operation of the leachate extracting system. Use of leachate wells for monitoring leachate levels in landfills is inappropriate because the results would be completely misleading. This is because the liquid levels in each extraction well do not represent the leachate levels in the landfill. The design of monitoring system should consider achieving the zone of influence of the extraction system, extraction wells spacing, and placement of monitoring points.

The monitoring for the leachate tank is recommended as follows:

- **Daily for first month of operation.**
- **Weekly for next three months, if the daily measurements show that the leachate flows can be monitored from the office.**
- **Quarterly thereafter.**

The USEPA must approve any monitoring frequency before it is implemented, including any proposed frequency of less than quarterly.

Response: As discussed in the O&M Plan, each load of leachate transported off-site will be reported. For consistency of reporting in the quarterly reports to the USEPA, the weekly leachate loadout summation stated on Plan Sheet No. 11 was proposed. Considering that other measures exist to ensure efficient and timely leachate transport from the site (e.g., remote dial-in and high level alarms and dial-ups), WMI believes that the weekly leachate loadout summation is appropriate.

As discussed in Subsection 4.2 of the RD Report, prior to leachate elevation measurements, the extraction pumps will be turned off for a minimum period of 12 hours to allow for liquid recovery in the wells prior to measurement. To evaluate if an inward gradient from the shallow sand aquifer, located to the south of the site, water level measurements (see Plan Sheet No. 11) are a part of the proposed environmental monitoring program. Along with water measurements obtained during the quarterly sampling of groundwater monitoring wells and Sequoit Creek surface water levels at SW1 and SW2, a comprehensive network exists for evaluation of the stated performance objectives of the leachate management system.

The PSVP outlines the procedures for requesting approval of, and implementing changes to, the monitoring requirements proposed in the approved RD.

Specifications

56. **Comment: Include Division 1 of the Specifications in the prefinal design submittal.**

Response: Division 1 Specifications have been added to the design submittal.

57. **Comment: Page 3-1, section 3.1.2.: Division 2 specifications do not include a section for waste reconsolidation and special waste handling such as drums.**

Response: A Waste Relocation and Drum Contingency Plan has been added as Appendix E of the RD Report.

58. **Comment: Page 3-3, Section 3.1.4: Specifications should address borrow area management during construction and restoration. A proposed final grading plan should be included.**

Response: Excavation, final grading, and restoration of the borrow area are discussed in Subsection 3.1.4. A proposed final grading plan for the borrow area is not deemed necessary since the amount of soil to be extracted is dependent upon the amount of waste that needs to be relocated. However, the final restoration grades of the borrow area will blend with the existing topography and promote surface water runoff in a controlled manner.

59. **Comment: In Specification Section 02522, Part 2.3 and 3.3 regarding well seals, which description matches the "hydrated bentonite plug" specified in Detail 5 on Sheet 12? Use consistent terminology between specifications and plans.**

Response: Detail 5 on Plan Sheet No. 12 has been modified to read "HYDRATED BENTONITE SEAL" to match the wording in the specification.

60. **Comment: Specification 02526 does not dictate which wells will be abandoned, nor is this shown on the plans. Please clarify the application of this specification.**

Response: Plan Sheet 11 has been updated regarding the locations of the wells that are to be abandoned.

61. **Comment: Specification Section 02618, Part 1.1 identifies dual containment HDPE pipe. Nothing on the plan sheets indicates the application of dual containment piping. Please clarify or remove this reference from the specification.**

Response: Dual containment HDPE piping is not proposed. This reference has been removed from Specification Section 02618, Part 1.1.

62. **Comment: In accordance with the requirements of the ROD (page 55), Specification Section 02830, page 5, should indicate a locking mechanism will be provided. Page 3-25 of the Remedial Design Summary should also indicate the provision of locking gates.**

Response: Specification Section 02830, Subsection 2.5.E., indicates a "padlock eye" and that the owner will furnish locks to control site access. Text in Subsection 3.7.2 of the RD report has also been modified to reference a locking mechanism.

63. **Comment: Specification 16010 - Control Panel, Part 1.1A states that there are two control panels. Part 1.1B and Sheet 7 indicate there are three control panels - the main control panel, the leachate control panel, and the flare control panel. Correct for consistency.**

Response: Specification 16010 has been updated such that three control panels are referenced.

64. **Specification Section 16010**

A. **Comment: Need to add point(s) for leachate tank system monitoring.**

Response: Interstitial space will be monitored manually and not with electrical leak or level sensing equipment.

B. **Comment: Provide intrusion alarm for the building.**

Response: An intrusion alarm is not felt to be a critical component of this system and has not been included in the design.

65. **Section 11211**

A. **Comment: 2.2.E calls for flow totalizers; show totalizers on P&ID.**

Response: Flow totalizers are not proposed; rather, a local readout display will be incorporated.

B. **Comment: How is the full tank shutoff at the leachate tank tied into the air supply lines or shown on P&ID?**

Response: This is referenced in specification Section 15985, 2.3.d.

C. **Comment: 3.3: Pressure testing should be conducted at the expected air pressure of the supply which is listed at 100 psi; recommend using water at 1.5 x system pressure, or air at supply pressure. The 5 psi will not guarantee system integrity at 100 psi.**

Response: Per specification 02618, 3.5.F., testing of the air supply line and the leachate forcemain will be with air at 140 psi. The LFG header pipe will be tested with air at 5 psi.

66. **Section 15211:**

A. **Comment: Why is the compressor not an oil-less unit?**

Response: The compressor type incorporated in the design is recommended by pneumatic pump manufacturers.

B. **Comment: Will there be an hour meter in the PLC also?**

Response: An hour meter to show run time is proposed in the PLC.

C. **Comment: 2.2.C: The warranty should begin at acceptance (successful startup).**

Response: The comment is noted.

67. **Section 15695:**

Comment: In 2.2.A, the referenced section 2.02 is not in the specifications.

Response: Reference has been dropped.

68. **Comment: No specifications are provided for diaphragm pumps or for the sump pump. Specifications for ground flare are very general and need more detail.**

Response: See response to comment No. 20.

Schedule

69. **Comment: On the Schedule provided in Section 5, does task 10, Site Grading, include the cover material placement (i.e. low permeability fill and topsoil)? How can seeding and mulching start and finish before grading is completed?**

Response: The Schedule included in Section 5 has been updated such that seeding and mulching begin and end after grading is near completion. Site grading includes both cover material and vegetative cover/topsoil placement.

70. **Comment: Why are seeding and mulching completed prior to finishing the following?**

1. **Gravel access road.**
2. **Blower/flare station.**
3. **Perimeter fence.**

It is recommended that seeding be completed after these items are done.

Response: Per response to comment No. 69, the seeding and mulching component has been accordingly moved in the schedule provided in Section 5.

Alarms

71. **Comment: The information regarding which alarms are tied into the auto dialer is not provided in this design and must be included in the prefinal design. Furthermore, how the alarms will be responded to is not clear. The prefinal design should provide information on response time by the owner of the facility or by the owner's designee when an alarm is received.**

It is not clear at what leachate level in the leachate storage tank the alarm would be triggered. It is also not known what is the lead time necessary to have leachate pumped out of the tank to be sent to an off-site facility. This information should be included in the predesign deliverable.

Response: Following initial startup of the LCS, leachate will be removed from the site on a set schedule that will be established following the collection of system performance information. In the event that the leachate high-level alarm is triggered between scheduled loadouts (i.e., when the tank is at approximately 75 percent capacity), the warning light is turned on and the auto dialer will notify the leachate hauling vendor of this condition. Response to this high-level alarm condition will typically be within

24 hours. The high-high alarm is triggered when the tank is near design capacity. At this point, the system is shut down by redirecting the air in the three-way valve shown on Plan Sheet No. 9. This acts to shut down the air compressor. In addition to shutting the leachate collection system down, the auto-dial system will call both the leachate hauling vendor and WMI. In order to turn the leachate collection system back on, the manual reset on the control panel must be pushed. The system will not automatically reset if the high-high alarm is still active.

The autodialer will also call WMI personnel in the event of flare shutdown. The response time to this alarm will typically be within 24 hours.

In addition to responses to the autodialer, WMI personnel may dial into the system to check for normal operations at any time, via the PLC.

Further information on alarms, response times, response actions, and checking system operations is included in the O&M Plan and in the specifications.

Gas Monitoring Probe

72. **Comment: How much of the screen will remain above the water table? The probe should not be set such that it will be fully submerged. Provide detailed specifications and drawings.**

Response: Detail 5 on Plan Sheet No. 14 is for a typical gas monitoring probe. As indicated on this detail and in Subsection 3.3.6 of the RD report, the screen starts 5 feet below ground surface and extends to 4 feet below the water table. Since the water table may be variable, the amount of screen above the water table will be variable, and in some cases, Barhole probing techniques will have to be utilized to monitor areas where the water table exists at a depth less than 5 feet below ground surface.

Gas Extraction Wells

73. **Comment: It is recommended that for each gas extraction well a small auger be used to drill a pilot hole to determine the bottom of the waste. A bentonite seal is not a best option because there may be some heaving conditions due to expansion, and the bentonite may get into the screen.**

Response: A pilot hole is not considered necessary and will not be used to determine the bottom of waste. The bottom of waste will be determined during the course of the drilling for the installation of the well. The proposed bentonite seal location has been utilized in numerous instances and is not expected to cause a problem.

ARARs (Table 2-1)

74. **Comment: ARAR 811.308 is shown as not applicable, but USEPA considers this ARAR to be relevant and appropriate.**

Response: The comment is noted. This ARAR was evaluated during the design process and, while a basal leachate collection system (LCS) is not part of the leachate management system at the site, the intent of the ARAR regarding leachate system maintenance issues are addressed in the O&M Plan.

75. **Comment: On the last page of the table, change "311.312(e)" to "811.312(e)."**

Response: The reference to "311.312(e)" has been replaced with "811.312(e)" on the last page of Table 2-1.

76. **Comment: In cases where the action-specific ARAR designations and descriptions in the Intermediate Design do not match those of the ROD, the ROD action-specific ARAR designations and descriptions take preference, unless otherwise noted by USEPA.**

Response: Reference to ARARs in the RD Report were taken from the ARAR tables (Tables 11, 12, and 13) in the ROD. Evaluation of ARARs, as part of the design process, was outlined in the RD/RA Workplan. Throughout the RD Report and supporting documents, WMI has referenced ARARs used for the design and monitoring basis, and has discussed ARARs that are not appropriate for design/monitoring as indicated in Table 2-1.

Surface Water Monitoring

77. **Comment: On page 4-2, section 4.3, change the wording to state that quarterly surface water monitoring will continue until the Five-year Review, at which time the PRPs may petition USEPA for reduced monitoring. Also, change the chart on Sheet 11 accordingly.**

Response: The wording in Subsection 4.3 and on Plan Sheet No. 11 has been modified such that, at a minimum, quarterly surface water monitoring will be continued until the Five-year Review. At this point, WMI may petition for reduced monitoring per the language included in the PSVP.

References Used in Response to Comments

Benson, C.H. and Pliska, R.J. (1996). Final covers: HELP needs help from the field. *WasteAge.* March, 1996.

Edil, T.B., Valleri, J.R., and Wuellner, W.W. (1990). Settlement of municipal refuse. Geotechnics of Waste Fills - Theory and Practice, ASTM STP 1070, A. Landva and G.D. Knowles, eds., American Society for Testing and Materials, Philadelphia, 1990.

EMCON Associates (1998). Municipal solid waste landfill gas design review. Student Manual, APTI Workshop T018, 1st ed., NC State University, College of Engineering, Industrial Extension Service, Environmental Programs.

Gibson, R.E. and Lo, K.Y. (1961). A theory of soils exhibiting secondary compression. Acta Polytechnical Scandin Avica, C; 10 296, 1961, p. 1-15.

Khire, M.V., Benson, C.B., and Bosscher, P.J. (1997). Water balance modeling of earthen final covers. J. of *Geotech. and Geoenv. Engrg.*, Vol. 123(8), Aug., 1997.

Sowers, G.F. (1973). Settlement of waste disposal fills. Proceedings, 8th International Conference on Soil Mechanics and Foundation Engineering. Moscow, 1973.

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Integrated Environmental Solutions

744 Heartland Trail 53717-1934
P.O. Box 8923 53708-8923
Madison, WI
Telephone: 608-831-4444
Fax: 608-831-3334

May 18, 2000

Mr. Ron Murawski
Remedial Project Manager
USEPA-Region V
77 West Jackson Blvd.
Chicago, IL 60604-3504

Dear Ron:

Enclosed are the missing Attachments 1 and 2 from to the Response to USEPA Region 5's Comments on the Intermediate Design for the H.O.D. Landfill. Attachment 1 corresponds to question 5 on page 3, and Attachment 2 corresponds to question 33 on page 19.

Please call me at 608-662-5374 or Larry Buechel at 262-253-8626 if you have any questions.

Sincerely,

RMT, Inc.

Mark J. Torresani

Mark J Torresani
Project Manager

Attachments: Attachment 1-Soil Boring Logs
Attachment 2-Figure

cc: Larry Buechel, Waste Management, Inc.
Greg Ratliff, Illinois Environmental Protection Agency
Omprakash Patel, Weston

Attachment 1
Soil Boring Logs

SOIL BOREHOLE LOG

SITE NAME AND LOCATION H.O.D. Landfill Antioch, Illinois Note: EPA samples were described on 7/20/89 and 7/21/89 in Northbrook, Illinois	DRILLING METHOD SAMPLING METHOD Samples collected by Ecology and Environment	BORING NO. US-5D SHEET 1 of 3

					DRILLING	
					START	FINISH
WATER LEVEL					TIME	TIME
TIME						
DATE					DATE	DATE
CASING DEPTH						

DATUM MSL ELEVATION 765.19 *

DRILL RIG	SURFACE CONDITIONS
ANGLE / BEARING	* Top of concrete pad
SAMPLE HAMMER TORQUE	

DEPTH IN FEET (ELEVATION)	BLOWS/ 6IN. ON SAMPLER (RECOVERY)	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER& BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS: WATER CONTENT%	LIQUID LIMIT %	PLASTIC	SPECIFIC GRAVITY	OTHER TESTS
0											
2.5 - 4.0		CL OH	Clay: Oxidized, organic, with some pebbles, non-calcareous, 10YR 5/4.								
7.5 - 9.0		CL	Clay: Oxidized with mottled organic rich zones, slightly calcareous, some very fine limestone gravel, 10YR 5/4.								
10.5 - 12.0		CL	Clay (45%): Silty (55%), calcareous, with irregular silty layers at base (5mm) with abrupt contacts, very small limestone pebbles, 10YR 6/2.								
15.5 - 17.0		CL	Clay (70%) - Silty (30%), massive, plastic, cohesive, with mottled horizontal silty zones, trace coarse sand, very slightly calcareous, 5N.								
20.5 - 22.0		CL	Clay: As above, less mottling.								

LOGGED BY Jay S. Johnston DATE 07/21/89 CHK'D BY W.J. Powell (1/1/89) SL30262

SOIL BOREHOLE LOG

SITE NAME AND LOCATION H.O.D. Landfill Antioch, Illinois	DRILLING METHOD	BORING NO. US-5D
		SHEET 2 of 3
	SAMPLING METHOD Samples collected by Ecology and Environment	DRILLING START TIME / FINISH TIME
	WATER LEVEL / TIME / DATE / CASING DEPTH	DATE / DATE
DATUM MSL ELEVATION 765.19 *	DRILL RIG	SURFACE CONDITIONS
	ANGLE / BEARING	* Top of concrete pad
	SAMPLE HAMMER TORQUE	

DEPTH IN FEET (ELEVATION)	BLOWS/ 6IN. ON SAMPLER (RECOVERY)	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER & BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS: WATER CONTENT %	LIQUID LIMIT %	PLASTIC	SPECIFIC GRAVITY	OTHER TESTS
30.5 - 32.0		CL	Clay: Same as 15.5 - 17.0, less mottling.								
45.0 - 46.5		CL	Clay (45%) - Silt (55%), massive, trace coarse sand, dense, 7N (D), 5N (W).								
55.0 - 56.5		CL	Clay (60%), Silty, massive trace coarse snd, dense, very slightly calcareous, 5N.								
60.5 - 62.0		CL	Clay: As above, with mottled silty zones.								
70.0 - 71.5		CL	Clay (70%) - Silty (30%), dense, massive, slightly calcareous; with an increase in silt at base; irregular dipping contact, 7N.								
75.0 - 76.5		CL	Clay (45%), silty, dense, massive, slightly calcareous, some fine limestone gravel, 4N.								

LOGGED BY Jay S. Johnston DATE 07/21/89 CHK'D BY W. J. Powell (1/16/90) DRILLING CONTR

SOIL BOREHOLE LOG

SITE NAME AND LOCATION H.O.D. Landfill Antioch, Illinois	DRILLING METHOD		BORING NO. US-5D
			SHEET 3 of 3
	SAMPLING METHOD		DRILLING
	Samples collected by Ecology and Environment		START / FINISH
	WATER LEVEL		TIME / TIME
	TIME		
	DATE		DATE / DATE
DATUM MSL ELEVATION 765.19 *	CASING DEPTH		

DRILL RIG	SURFACE CONDITIONS
ANGLE / BEARING	* Top of concrete pad
SAMPLE HAMMER TORQUE	

DEPTH IN FEET (ELEVATION)	BLOWS/ 6IN. ON SAMPLER (RECOVERY)	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIAL	SAMPLER & BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS: WATER CONTENT %	LIQUID LIMIT %	PLASTIC	SPECIFIC GRAVITY	OTHER TESTS
80.0 - 81.5		CL --- ML --- SM	Interstratified 1.5" layers of silty sand, silty clay, and silt, calcareous, abrupt irregular contacts clay layers are mottled with silty zones, 10YR 6/2 (D), 10YR 4/2 (W).								
85.0 - 86.5		SP	Sand: Very fine grained, moderate to well sorted, with some small limestone gravel, 10YR 6/2.								

PRELIMINARY DRAFT
SUBJECT TO REVISION

LOGGED BY Jay S. Johnston SL30264 DATE 07/21/89 CHK'D BY W.J. Powell(1/1600) DRILLING CONTR

SOIL BOREHOLE LOG

SITE NAME AND LOCATION: H.O.D. Landfill - Antioch, Illinois	DRILLING METHOD: 4 1/4" IDHSA	BORING NO. GP3
		SHEET 1 OF 1
	SAMPLING METHOD: 5 FT CME SAMPLING TUBE	
BORING LOCATION: SW 1/4 of SW 1/4 of Section 9 , T 46 N, R 10 E/W	WATER LEVEL / TIME / DATE / CASING DEPTH	DRILLING START TIME: ---; DRILLING FINISH TIME: ---; START DATE: 4/21/93; FINISH DATE: 4/21/93
NORTHING 2116615.5 EASTING 1052220.9		
DATUM ELEVATION 770.8		
DRILL RIG: CME 750 ATV	SURFACE CONDITIONS: GRASS COVERED SURFACE	
ANGLE: Vertical BEARING: -----		
SAMPLE HAMMER TORQUE FT-LBS		

DEPTH IN FEET (ELEVATION)	BLOWS/6 IN. ON SAMPLER	RECOVERY %	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIALS	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS: WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	SPECIFIC GRAVITY	OTHER TESTS
0	-	63		1 Brown TOPSOIL, Roots Present, Clayey Little to Some Sand to 1 Foot over Brown Sandy Clay to Silty Clay, Little to Some, Fine to Medium Sand to 2 Feet over 6" Moist Sand Layer	SB							1->4.5
768.3												
5	-	100		2 Hard Brown and Gray Streaked Silty CLAY (CL), Little Fine to Coarse Sand, Grades to Little Fine Gravel, Limonite Patches and Gray Streaks Hard Brown Silty CLAY (CL) Trace to Little Fine to Coarse Sand, Trace Fine Gravel, Gray Streaks Present	SB							>4.5
10	-	97		3 PID None Detected	SB							>4.5-3.5
758.8				Very Stiff to Hard Gray Silty CLAY (CL), Trace to Little Fine to Coarse Sand, Trace Gravel								
15	-	100		4 PID None Detected	SB							2.75->4.5
20 750.8				End of Boring at 20 Feet Gas Probe Set at 19.85 Feet								
25												
30												
35												

LOGGED BY SJC DRILLING CONTR E&F

DATE 9/22/93 CHK'D BY DAP CHAS. MARKGRAF

Template ID: WM1 ID: WM1

SOIL BOREHOLE LOG

SITE NAME AND LOCATION: H.O.D. Landfill - Antioch, Illinois

BORING LOCATION: SE 1/4 of SE 1/4 of Section 17 , T 46 N, R 10 E/W

NORTHING 2116648.2 EASTING 1052499.9

DATUM ELEVATION 770.7

DRILL RIG: CME 750 ATV

ANGLE: Vertical BEARING: ------

SAMPLE HAMMER TORQUE FT-LBS

DRILLING METHOD: 4 1/4" ID HSA

SAMPLING METHOD: 5' CME SAMPLING TUBE
2" OD SPLIT SPOON (84-88 FT)

BORING NO. W2D

SHEET 1 OF 2

	DRILLING START	DRILLING FINISH
WATER LEVEL		
TIME	TIME	TIME
DATE	DATE	DATE
CASING DEPTH	4/17/93	4/17/93

SURFACE CONDITIONS: GRASS COVERED PRAIRIE

DEPTH IN FEET (ELEVATION)	BLOWS/6 IN. ON SAMPLER	RECOVERY %	SYMBOL		SAMPLE NUMBER AND DESCRIPTION OF MATERIALS	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS: WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	SPECIFIC GRAVITY	OTHER TESTS
769.2	–	75		1	Stiff to Very Stiff Reddish Brown Organic Top Soil (OH), Roots to 1 ft then Brown Silty Sandy Clay	SB							1-3.5
					Brown Silty CLAY (CL), Limonite Precipitate, Magnesium Nodules Present								
766.7													
765.7	–	83		2	Soft to Stiff Brown and Gray Mottled Clayey SILT to Silty CLAY (ML/CL)	SB				30	11		.25-1.0
					Grades to more silty CLAY (CL) Trace to Little Fine to Coarse Sand and Fine Gravel, Sand Pocket at 9 Ft								
761.7													
760.7	–	75		3	Brown SAND Layer (SP)	SB							2->4.5
759.2					Brown Silty CLAY (CL) to 11.5'								
					Gray Silty CLAY (CL), Little to Some Fine to Coarse Sand, Trace to Little, Fine to Coarse Gravel, Sand Lens at 12' and 14', Shale Fragments Present								
756.7													
	–	100		4	Gravelly Stiff to Very Stiff Gray Silty CLAY (CL)	SB							1.5-4.0
752.7													
	–	95		5	Gray Very Stiff Lean CLAY (CL), Little to Some Silt, Trace to Little Gravel and Fine to Coarse Sand	SB							2.5-3.0
					Gray Stiff to Very Stiff Lean CLAY (CL) Little to Some Silt, Trace to Little Fine to Coarse Sand, Trace Fine Gravel								
	–	95		6		SB							1.5-2.5
	–	90		7	Shelby Tube 29 - 31' Shale Fragments Present	SB				38	19		1.5-2.5
					Lean Clay (CL) Trace Gravel and Sand								
	–	100		8		SB							1-2.5
	–	93		9		SB							1.5-

LOGGED BY SJC

DATE 9/17/93 CHK'D BY DAP

DRILLING CONTR E & F

CHAS. MARKGRAF

Template ID: WM1 ID: WM1

SOIL BOREHOLE LOG

SITE NAME AND LOCATION H.O.D. Landfill - Antioch, Illinois

SHEET 2 OF 2

BORING NO. W2D

DEPTH IN FEET (ELEVATION)	BLOWS/6 IN. ON SAMPLER	RECOVERY %	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIALS	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS: WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	SPECIFIC GRAVITY	OTHER TESTS
												2.5
45 725.2	–	97		10 Grades to Lean Clay, Little Fine to Coarse Sand Grades to Medium Stiff to Very Stiff Coarse Gravelly Lean CLAY (CL)	SB							.75-2.5
50	–			11 Ribbon of Sample Pushed Rock, no Recovery, Gray CLAY	SB							–
55 716.2	–	27		12 Fossiliferous Limestone Cobble in Sample Possibly Pushed from Above Gray Lean Clay (CL) with a Silty Layer Grading into Silty CLAY, Clayey SILT (CL/ML) to 59'	SB							.5-3.0
711.7	–	97		13 Gray Stiff to Very Stiff Lean CLAY (CL) Trace Little Silt, Little Fine to Coarse Sand, Trace Fine Gravel	SB							1.5-2.5
60 65	–	100		14 2" Silty Fine Sand Layer at 65' and 1/2" Sand Lens 65.8'	SB							1.5-2.5
70	–	95		15 4" Silt Layer at 69.5' Over 1/2" Fine to Medium Sand Lens	SB							1.0-3.0
697.7 696.7				Gray Lean CLAY (CL), Little Fine Sand and Silt, Trace to Little Fine Gravel, Trace Coarse Sand								
75	–	98		16 Gravelly Medium Stiff to Very Stiff Pinkish Gray Clay Layer from 73'-74'	SB							.75-3.0
				Pinkish/Reddish-Gray Lean CLAY (CL), Little to Some Silt and Fine to Coarse Sand, Trace to Little Fine Gravel, Trace Coarse Sand								
▼ 691.7 80	–	13		17 Fine to Coarse SAND and Fine GRAVEL (SP/GP)	SB							–
85	9 11 14 14			19 No Recovery	SS							–
				18	SS							–
682.2	7 12 15 17			20 Fine to Coarse Medium Dense SAND (SP), Some Gravel, Little Silt, Trace Clay	SS							–
90				End of Boring 88.5 Feet PID = None Detected * = PID Malfunctioning Monitoring Well Set at 88.33 Feet								
95												

SOIL BOREHOLE LOG

SITE NAME AND LOCATION: H.O.D. Landfill - Antioch, Illinois

BORING LOCATION: SW 1/4 of SW 1/4 of Section 9 , T 46 N, R 10 E/W

NORTHING 2116326.0 EASTING 1053153.3

DATUM ELEVATION 780.2

DRILL RIG: CME 750 ATV

ANGLE: Vertical BEARING: ------

SAMPLE HAMMER TORQUE FT-LBS

DRILLING METHOD: 4 1/4" ID HSA

SAMPLING METHOD: 5' CME SAMPLE TUBE (0 - 94 FT) 2" OD SPLIT SPOON (94 - 100 FT) SHELBY TUBE (29 - 31 FT)

WATER LEVEL				
TIME				
DATE				
CASING DEPTH				

BORING NO. W7D

SHEET 1 OF 3

DRILLING START: TIME / DATE 4/13/93

DRILLING FINISH: TIME / DATE 4/13/93

SURFACE CONDITIONS: GRASS COVERED PRAIRIE

DEPTH IN FEET (ELEVATION)	BLOWS/6 IN. ON SAMPLER	RECOVERY %	SYMBOL		SAMPLE NUMBER AND DESCRIPTION OF MATERIALS	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS: WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	SPECIFIC GRAVITY	OTHER TESTS
779.2	–	92		1	Approximately 6 - 12" Black Top Soil, Organic Silt	SB							3.0-1.25
					Tan Laminated Silt (ML) With Limonite Precipitate, Grades to More Grayish with Laminated Limonite					33	14		
775.2	–	97		2	Gray Laminated Silty CLAY to Clayey SILT (CL/ML) Interbedded with Tan Silt	SB							3.0-1.25
5					Gray Lean Clay (CL), Little to Some Silt								
10	–	98		3	Gray Lean CLAY (CL) with Little to Some Silt, with Laminated Lenses of Silt, Little to Some Fine to Coarse Sand	SB							2.25-1.25
15	–	97		4	Gray Lean CLAY (CL) Little to Some Silt, Sand Pocket with Coarse Gravel at 15 Feet, Trace to Little Fine to Coarse Sand, and Fine Gravel, Shale Fragments Present	SB							2.5-3.25
20	–	97		5	Gray Massive Lean CLAY (CL), Trace to Little Silt and Trace Fine to Coarse Sand, Trace Fine to Coarse Gravel, Shale Fragments Approximately 6" Sandy Zone at 20 Ft	SB							2.0-1.5
25	–	85		6		SB				34	15		2.5-3.0
30	–	92		7	Shelby Tube to 31' Collected CME Tube Sample 29' to 34'	SB							1.5-2.5
35	–	97		8		SB							2.5-3.0
					Trace Shale Fragments								
	–	97		9		SB							2.0-

LOGGED BY SJC

DATE 9/17/93 CHK'D BY DAP

DRILLING CONTR E & F

CHAS. MARKGRAF

Template ID: WM1 ID: WM1

SOIL BOREHOLE LOG

SITE NAME AND LOCATION H.O.D. Landfill - Antioch, Illinois

SHEET 2 OF 3

BORING NO. W7D

DEPTH IN FEET (ELEVATION)	BLOWS/6 IN. ON SAMPLER	RECOVERY %	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIALS	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS: WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	SPECIFIC GRAVITY	OTHER TESTS
				Trace Shale Fragments								3.25
45	–	97		10	SB							2.5-3.0
50	–	97		11	SB							1.25-2.5
55	–	100		12	SB							2-3
60	–	100		13 Gray Lean CLAY (CL), Little Silt, Little Fine to Coarse Sand, Trace Fine to Coarse Gravel, Approximately 1/4mm to 1mm thick Silt Lenses and Pockets Interbedded in Clay	SB							1-2
65	–	100		14	SB							1.25-3
				Approximately 10" Silt Layer at 67 to 68 Feet								
70	–	100		15	SB							2.25->4.5
				3" Silt Layer at 71'								
				1/2" Silt Layer at 73', Silt Lenses Interbed								
75	–	97		16 Cobbles at 75'	SB							2.75-4.25
				3" Silt Layer at 76.5', Trace to Little Shale Fragments Present, Few Silt Pockets and Lenses in Clay								
80	–	98		17	SB							2.5-4
				Silty 2" Layer (Silty Clay Clayey Silt) at 81.5 Feet 2mm Silt Lens at 83'								
85	–	100		18	SB							3->4.5
692.7				1/2" Lens of Reddish Silty CLAY, Clayey SILT over 1" Lense of Gray Clayey SILT at 85' Grades to Grey CLAY (CL)								
90 690.2	–	75		19 Light Pinkish Gray Silty CLAY (CL), Little to Some Fine to Coarse Sand Little Fine Gravel, Trace Coarse Sand	SB							–
				Fine to Medium Sand (SP)								
				7" Gray Clay Layer at 92', Grades to Coarse Sand and Trace Clay, Gravel, and Silt, Fine Gravel at 95'								
95	16 12 12 12	8		20 Medium Dense Fine to Medium SAND (SP)	SS							–
	10 30 30 20	100		21 Very Dense Fine to Medium SAND to 97', Grades to	SS							–

SOIL BOREHOLE LOG

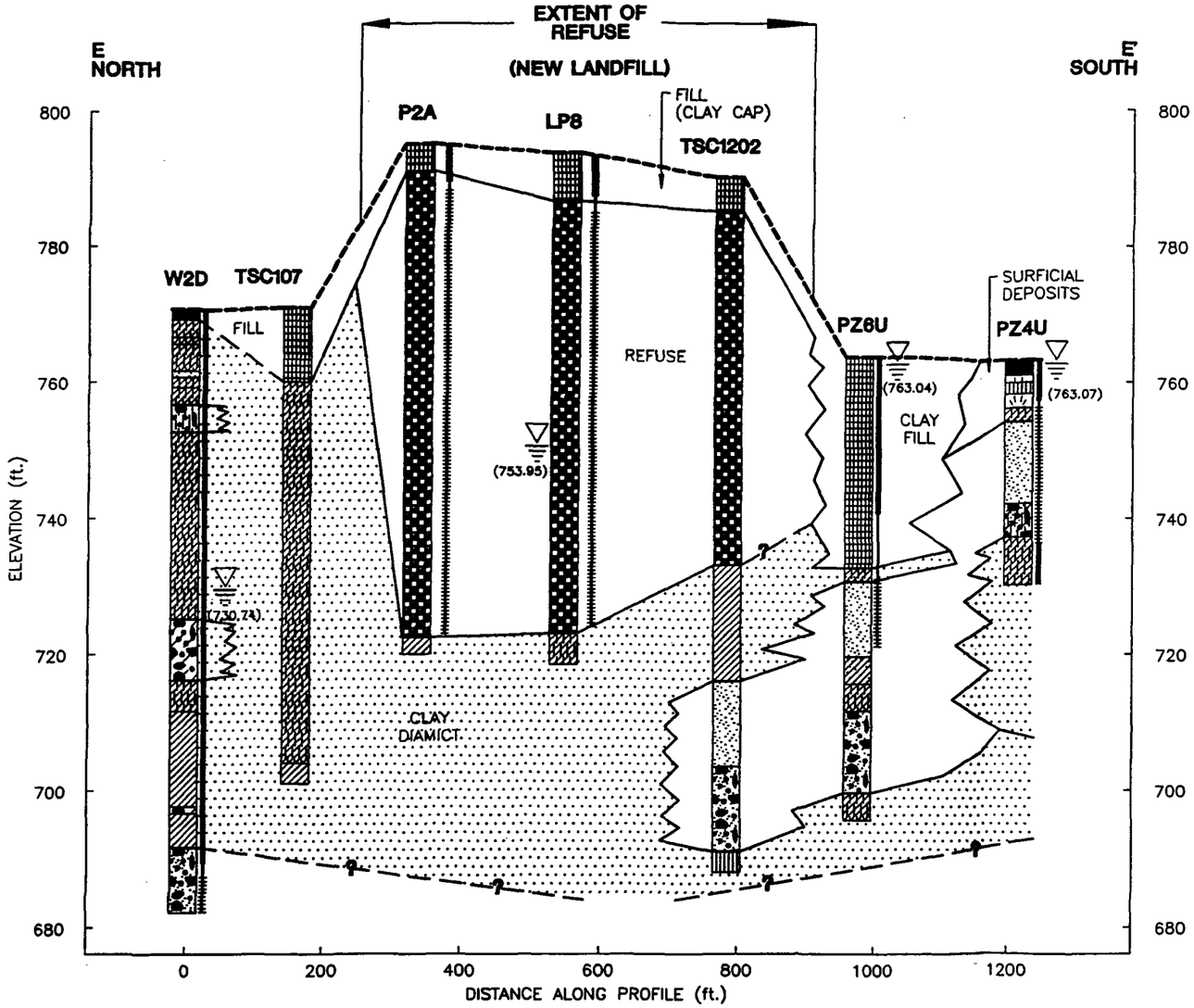
SITE NAME AND LOCATION H.O.D. Landfill - Antioch, Illinois

SHEET 3 OF 3

BORING NO. W7D

DEPTH IN FEET (ELEVATION)	BLOWS/6 IN. ON SAMPLER	RECOVERY %	SYMBOL	SAMPLE NUMBER AND DESCRIPTION OF MATERIALS	SAMPLER AND BIT	CASING TYPE	BLOWS/FOOT ON CASING	TEST RESULTS: WATER CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	SPECIFIC GRAVITY	OTHER TESTS
	8 10 16 20	75		22 More Fine, Trace to Little Fine Gravel Medium Dense Fine to Medium SAND (SP), Little Coarse Sand, Trace to Little Fine Gravel	SS							-
100 680.2				End of Boring at 100 Feet Monitoring Well Set at 99.94 Feet PID = None Detected								
105												
110												
115												
120												
125												
130												
135												
140												
145												
150												

Attachment 2
Figure 16



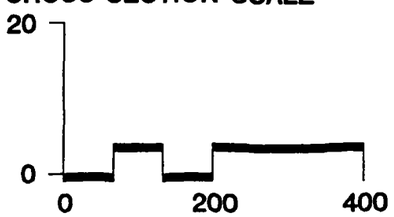
LEGEND

- SAND
- SILTY SAND
- CLAYEY SAND
- CLAYEY GRAVEL
- SAND AND GRAVEL
- SAND AND GRAVEL, SOME SILT AND CLAY
- SAND AND GRAVEL, SOME CLAY
- TOPSOIL
- PAVEMENT
- FILL
- REFUSE
- SILT
- SILTY CLAY
- LEAN CLAY
- (728.41) GROUNDWATER ELEVATION
- 82.6 TOTAL DEPTH OF WELL IN FEET BELOW GROUND SURFACE
- BACKFILLED WITH BENTONITE
- 2" I.D. RISER
- 2" I.D. SLOTTED WELL SCREEN
- GROUNDWATER/LEACHATE ELEVATION

NOTES

1. THE STRATUM LINES ARE BASED ON INTERPOLATION BETWEEN BORINGS AND MAY NOT REPRESENT ACTUAL SUBSURFACE CONDITIONS.
2. FOR THE PURPOSE OF ILLUSTRATING SUBSOIL CONDITIONS ON THE CROSS-SECTIONS, SOME OF THE BORINGS LOGS HAVE BEEN SIMPLIFIED. FOR A DETAILED DESCRIPTION OF SUBSURFACE CONDITIONS AT INDIVIDUAL BORINGS REFER TO SOIL BORING LOGS. (APPENDED TO REPORT)
3. COMPLETE MONITORING WELL INSTALLATION DETAILS ARE APPENDED TO REPORT.
4. HORIZONTAL DISTANCES ARE MEASURED WITH RESPECT TO THE CENTER OF EACH SOIL BORING LOCATION.
5. ELEVATIONS ARE SHOWN IN REFERENCE TO U.S.G.S. DATUM.
6. GROUNDWATER ELEVATIONS ARE BASED ON MEASUREMENTS OBTAINED BY WARZYN INC. ON JUNE 8 AND 9, 1993.

CROSS SECTION SCALE



SCALE IN FEET
VERTICAL EXAGGERATION: TEN TIMES

FIGURE 16

Management Review
Other
Technical Review
Project Manager
Graphic Standards
Lead Professional
QUALITY CONTROL

Developed By PMS
Drawn By CCM
Approved By
Date 11-7-97
Reference
Revisions

GEOLOGIC CROSS-SECTION E-E'

REMEDIAL INVESTIGATION
H.O.D. LANDFILL
WASTE MANAGEMENT OF ILLINOIS, INC.
ANTIOCH, ILLINOIS

Drawing Number
2386.009B24

MONTGOMERY WATSON